The Atmospheric Model Evaluation Tool

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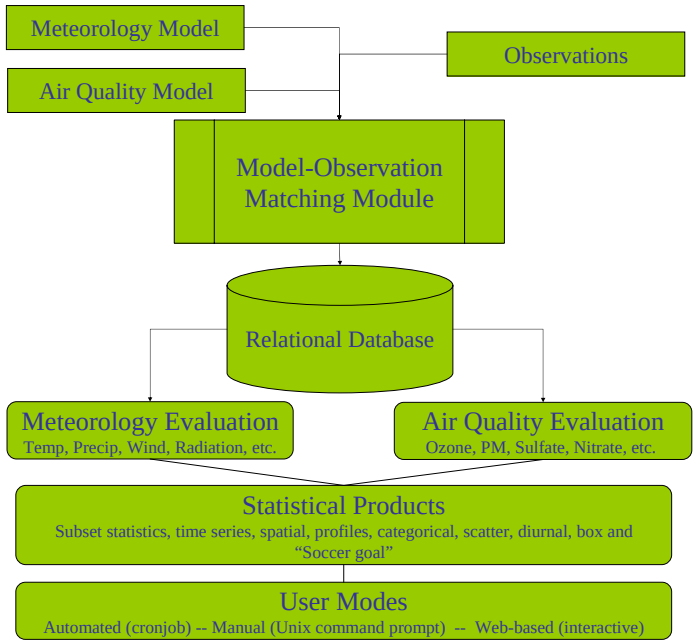
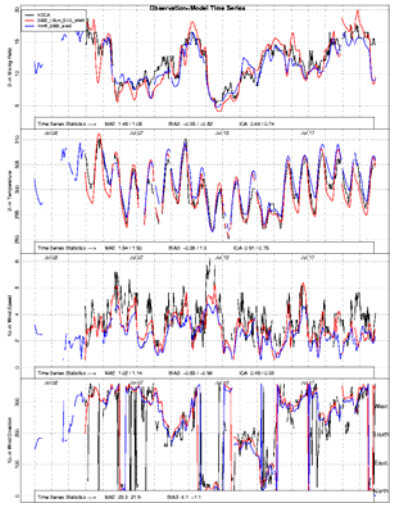
Overview

- Model simulations are on increasingly longer time scales and larger spatial domains
- Given the extensive amount of model output generated, the evaluation process can be labor intensive
- Significant need exists for model evaluation tools that can reduce the time required to perform meaningful and comprehensive model evaluation while still providing adequate flexibility
- To address this need, an interactive model evaluation tool, the Atmospheric Model Evaluation Tool (AMET), is being developed to support Models-3 CMAQ evaluation analyses
- AMET includes the capability to evaluate both meteorological and air quality simulations
- Benefits of an Evaluation System
  - Makes the model evaluation process more efficient and less labor intensive
  - Can be used to standardize evaluation process
  - Manages a large amount of data and results in an open source database
  - Provides a direct link between the meteorological and air quality model evaluations
- AMET tool utilizes several open-source programming languages, including FORTRAN, Perl, R and PHP (server-side HTML embedded scripting language)
- User-friendly web-based interface, along with a script-based interface
- Ability to query data based on many factors, including season, state(s), RPO region and lat/lon ranges (more criteria will become available in the future)
- Tool is being designed to flexibly adapt and expand its capabilities based on the needs of the user community
- AMET will be allowed to expand through user submitted code

Framework

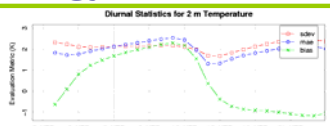


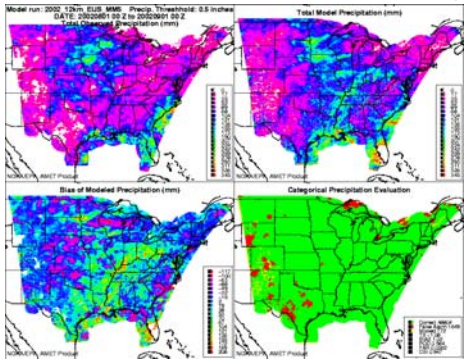
Meteorology Evaluation



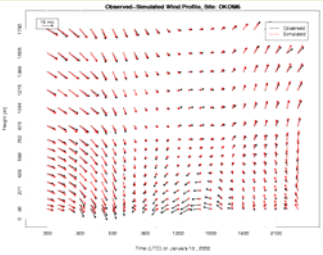
Time series (above) : 20-day comparison of observed versus simulated meteorology.

Diurnal Statistics (right): Temperature bias and error of model versus time of day.



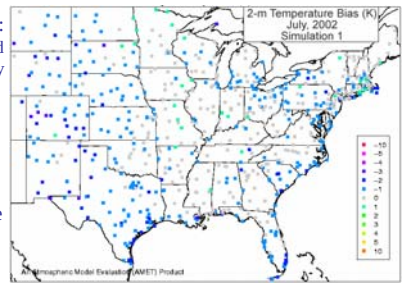


Daily Wind Profile (right): Diurnal profile comparison of simulated and observed wind vectors.



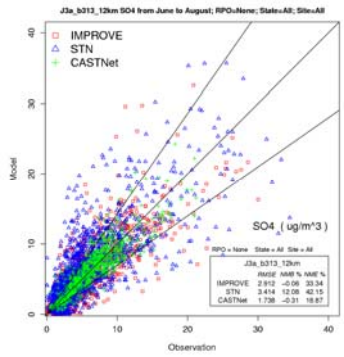
Precipitation (left) : Comparison of simulated and observed total monthly (August, 2002) precipitation.

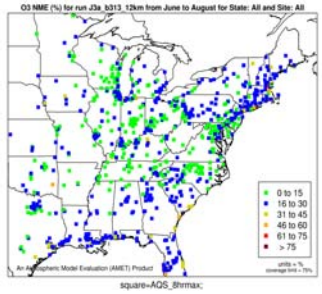
Spatial Statistics (right): Map of mean temperature bias computed for July 2002.



Air Quality Evaluation

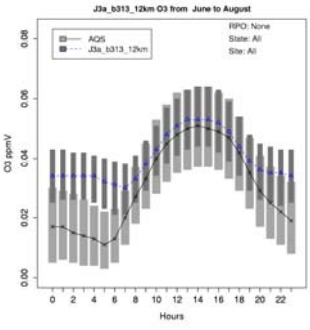
Scatter plots (example below) are available through the AMET air quality module, including plots of all model-obs pairs, temporal averaged model-obs pairs and model-to-model pairs. Several statistical measures are also included on the plot. Model-to-model scatter plots only match model values at the corresponding observational network site and not at every grid cell in the model domain.

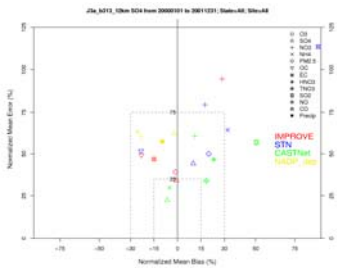




Spatial plots of various statistics (example above) are available, as well as plots of observation and model concentrations along with model-obs difference plots. Many aspects of the plots are generated automatically, including the title, legend and color scale. These plots are excellent tools for understanding how model performance varies spatially across the domain. Additional spatial plots should be available in the future.

Box plots (example to right) are available in the AMET air quality modules, one that displays monthly and one that displays hourly. The box plots show several quantities: the shading represents the 25% to 75% quartiles, while the lines represent the median values, for both model and observation concentrations. The hourly or "diurnal" box plot is used with hourly data, and shows how the model predictions compare against observations throughout an entire day.





The **"Soccer Goal" plot** (example to left) is a quick way to visualize model performance, as measures of both bias and error are shown on a single plot. As bias and error approach zero, the points are plotted closer to or within the "goal", represented here by the dashed boxes.

Disclaimer: *The research presented here was performed under the Memorandum of Understanding between the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Commerce's National Oceanic and Atmospheric Administration (NOAA) and under agreement number DW 13921548.*